

Particle Identification & Momentum Resolution

Step

1. Get momentum distribution of particles.
2. MC simulation with given range of momentum.
3. Apply dE/dx resolution.
4. Apply Momentum resolution.

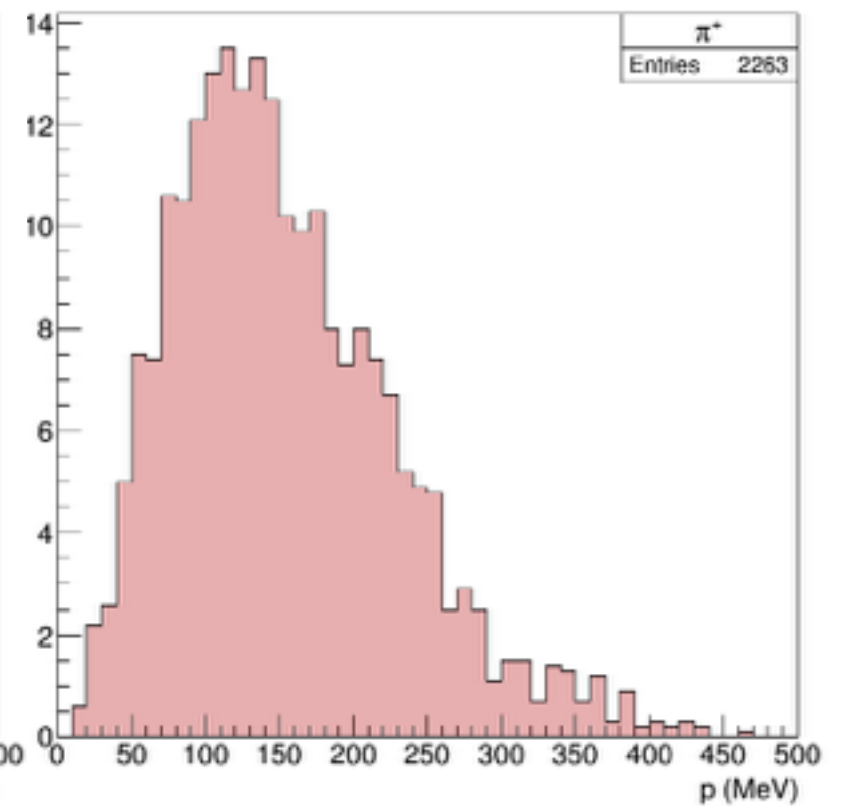
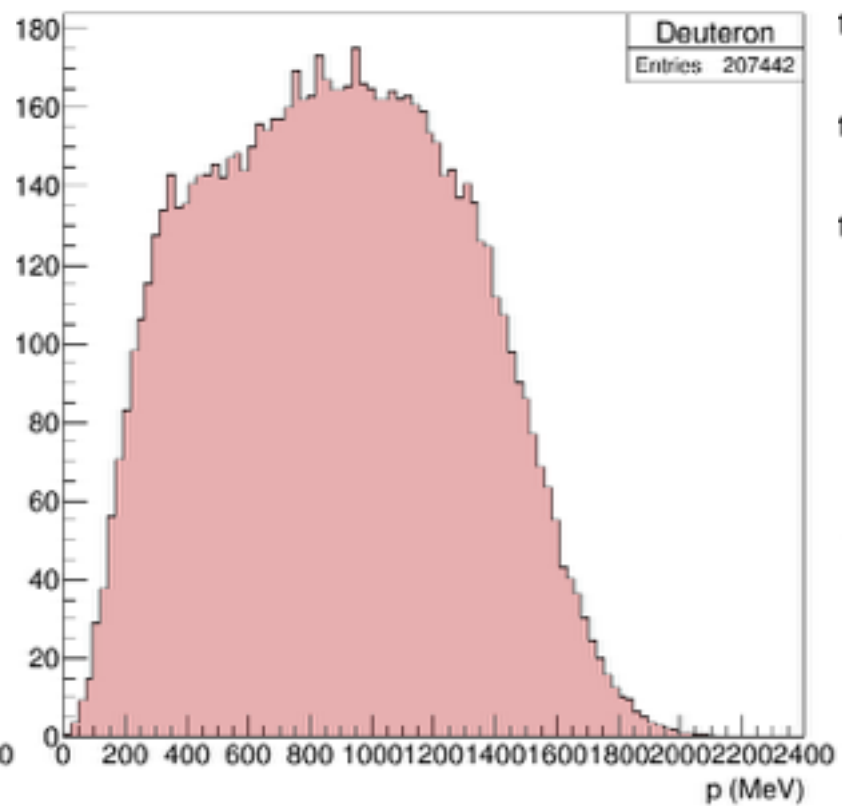
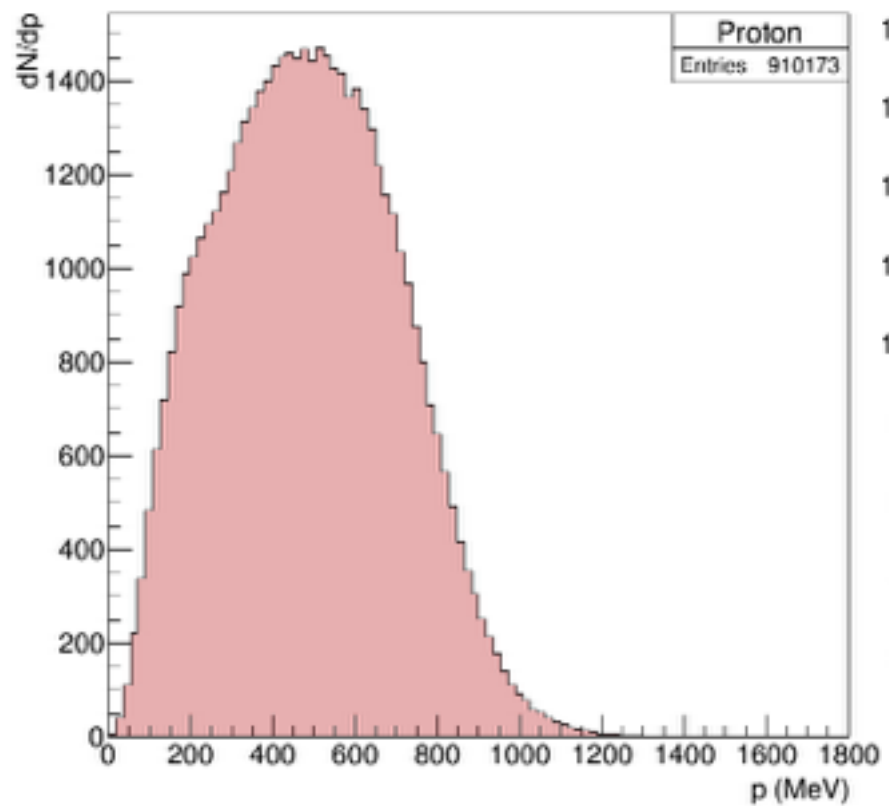
Momentum Distribution

IQMD AuAu 250 MeV/u Soft Model.

Proton (~33%)

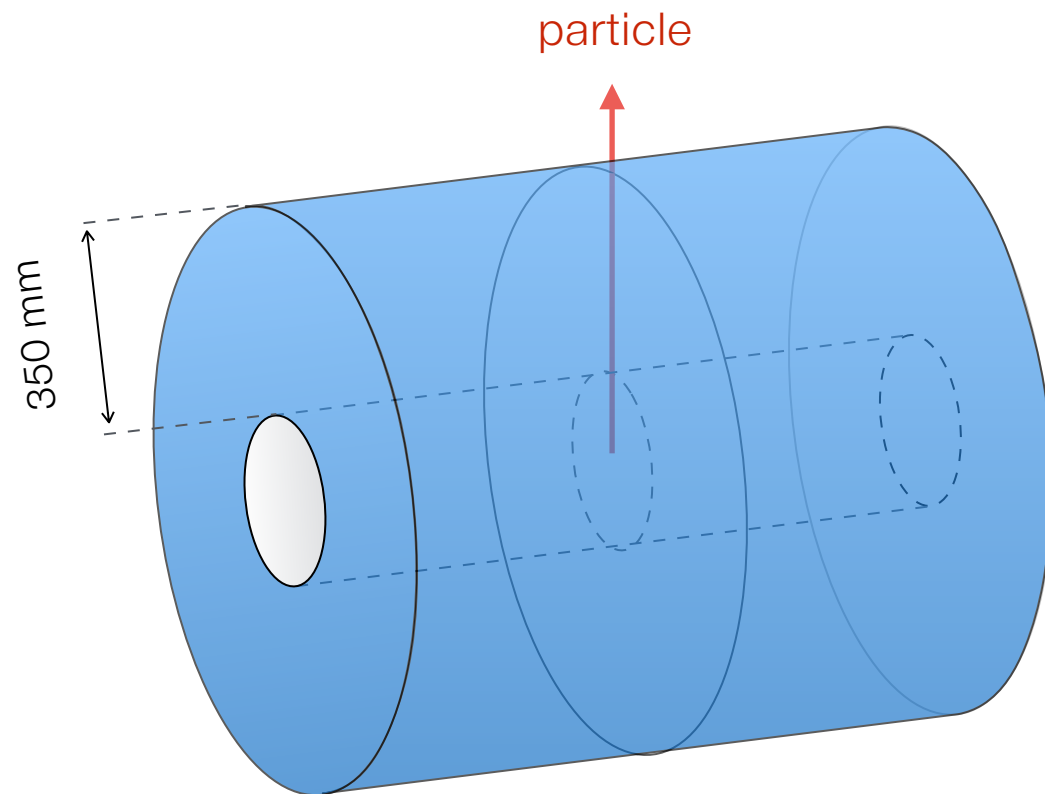
Deuteron (~7%)

π^+ (~1%)



MC Simulation

Ar/CO₂ (90/10) Gas

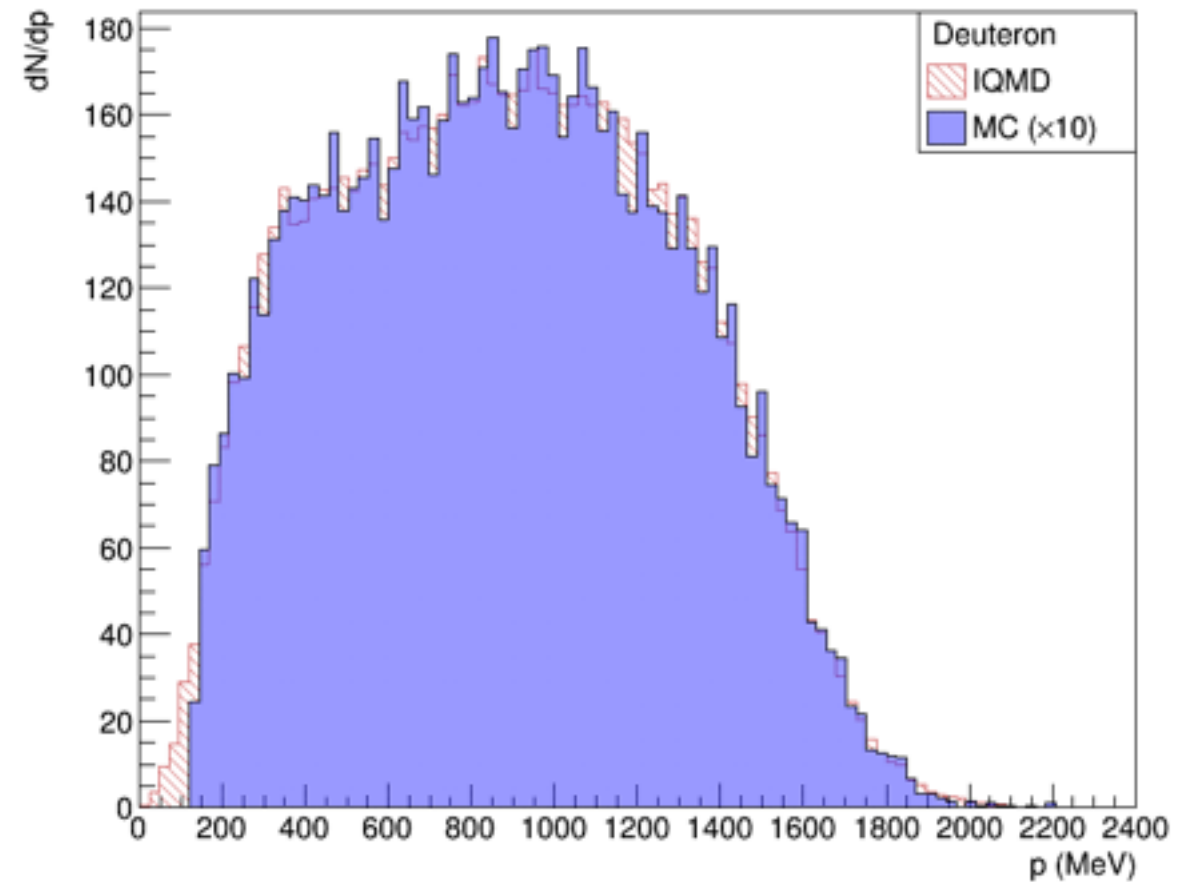
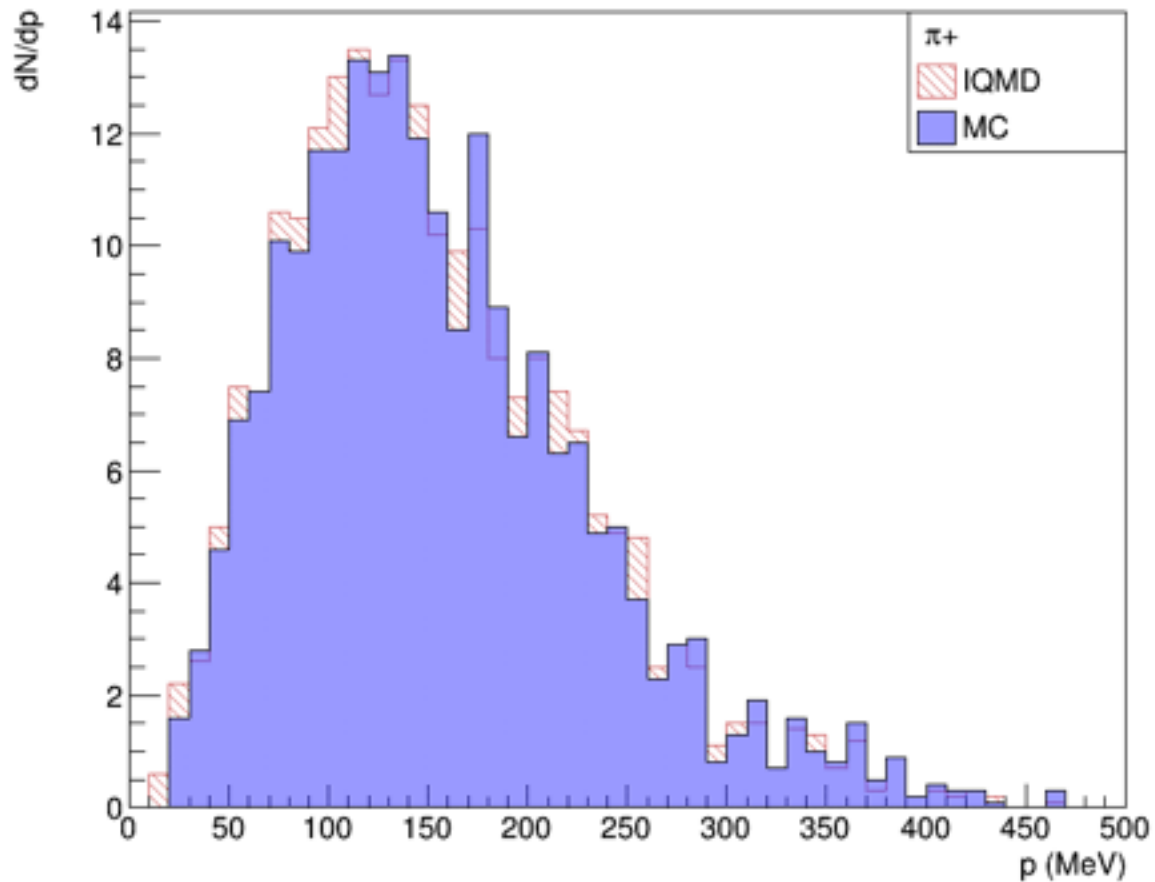
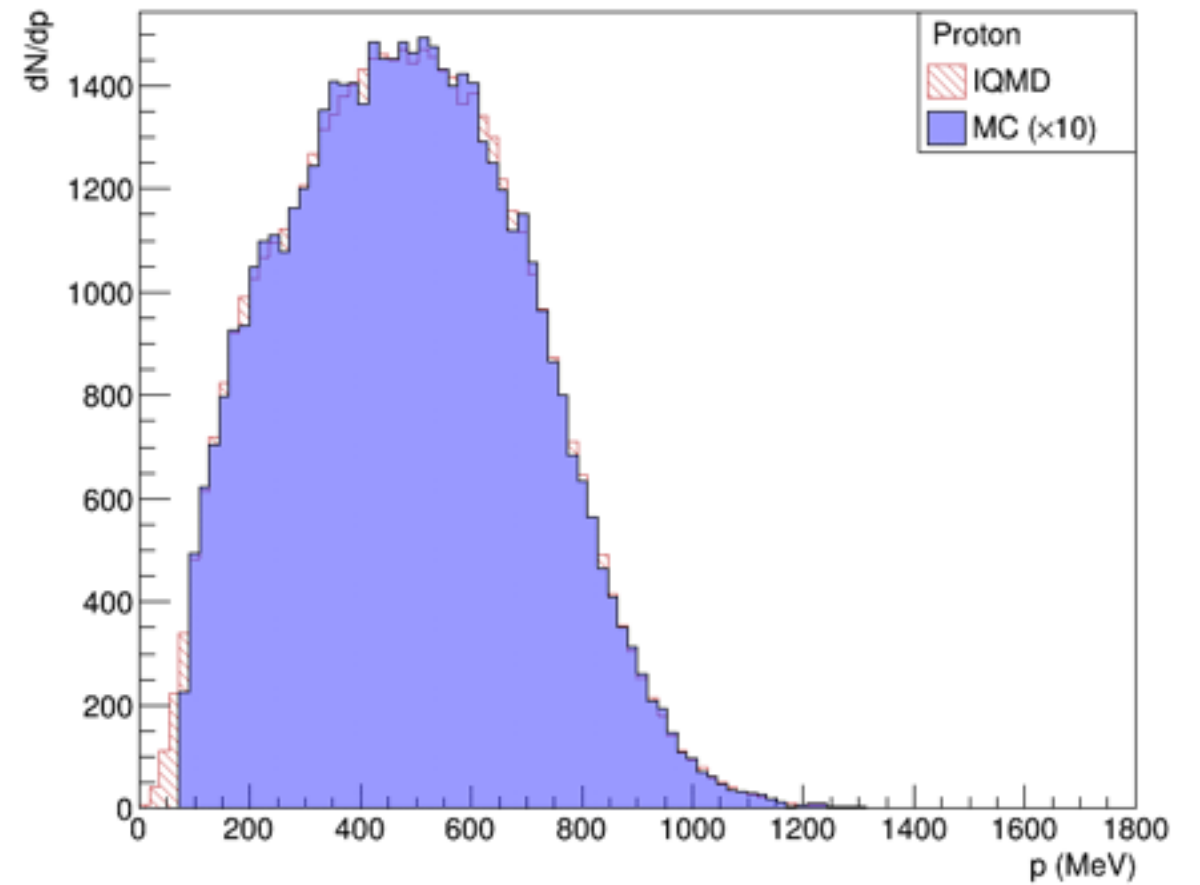


1. Fixed drift length = 350 mm
2. Random momentum distribution from IQMD data. (previous slide)
3. Event number, proportional to IQMD data. (previous slide)

Momentum Distribution

from

“IQMD Data”
“MC Simulation”

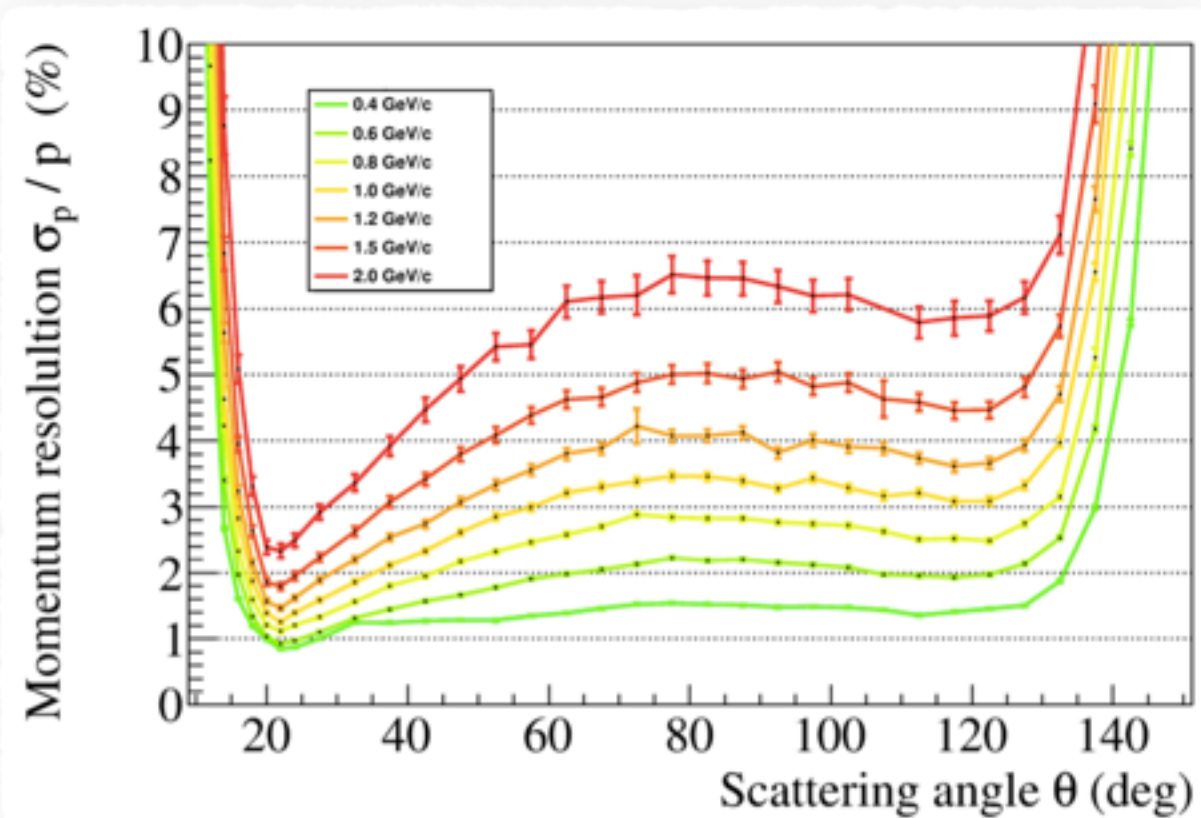


Resolution

$$\text{Resolution of } x = \frac{\sigma_x}{x}$$

Energy resolution at PANDA found to be always better than $\sim 10\%$.

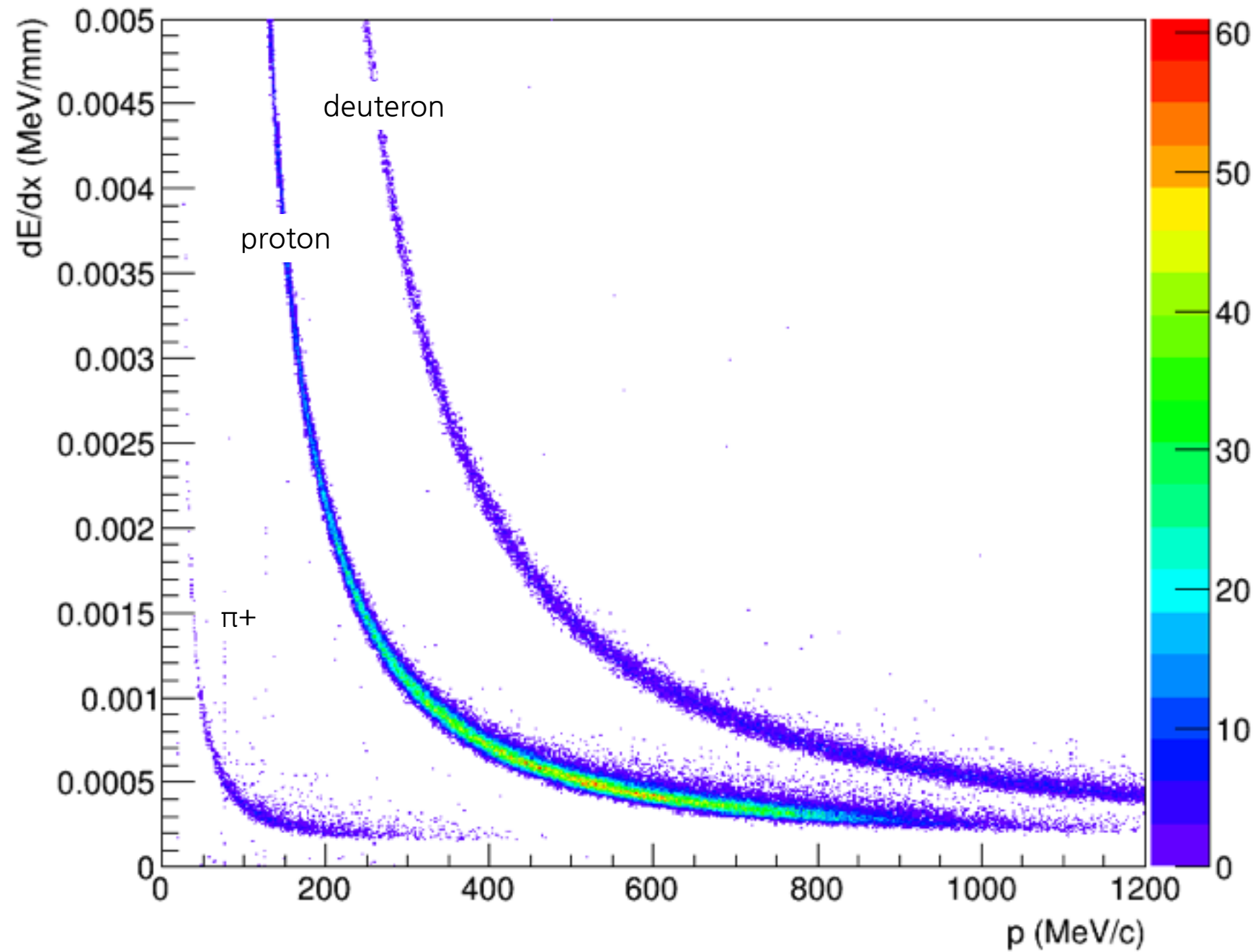
Momentum resolution :



Technical Design Report for PANDA Experiment
PANDA Collaboration (August 29, 2011)

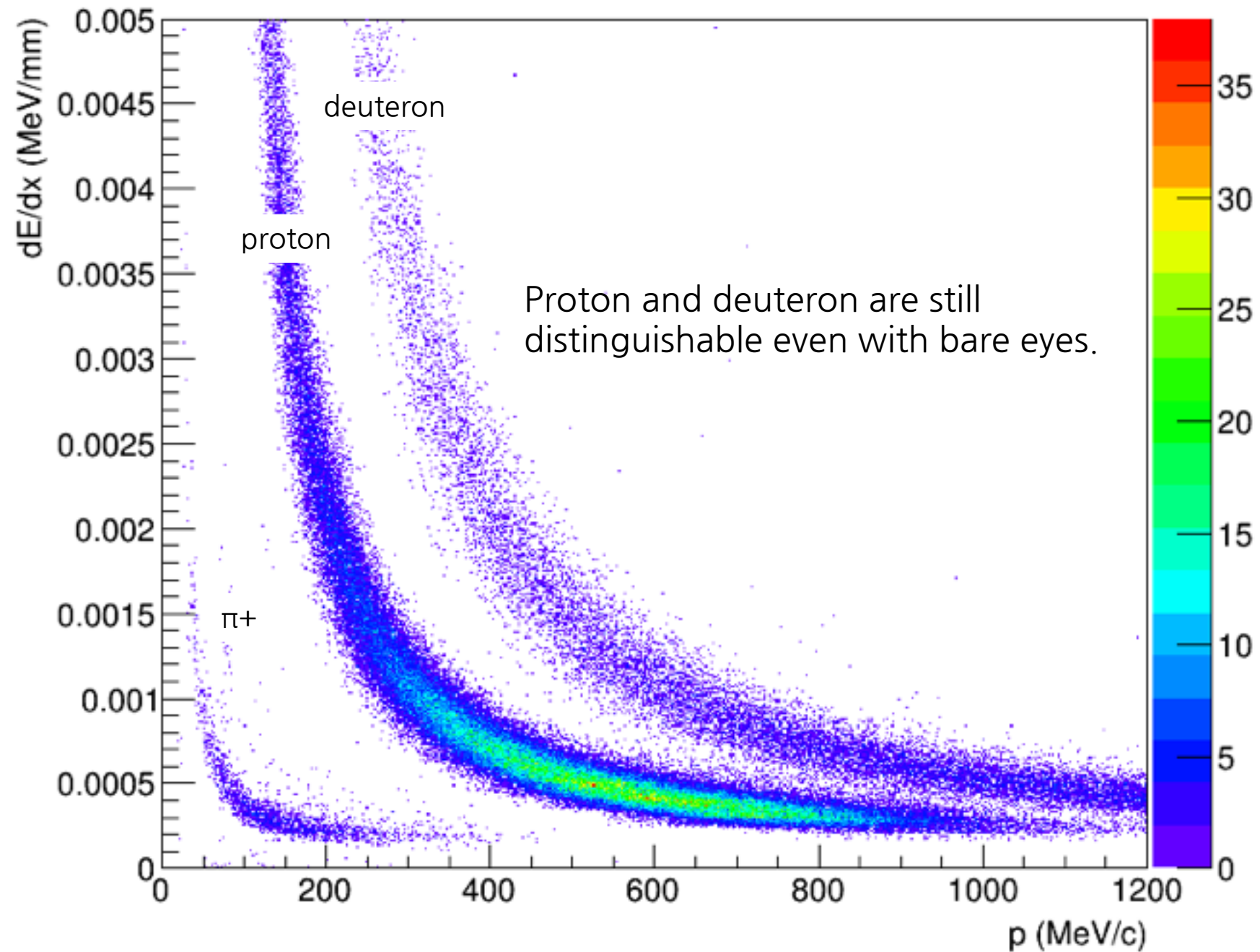
dE/dx Plot

Perfect Resolution
(no secondary particle hits collected)



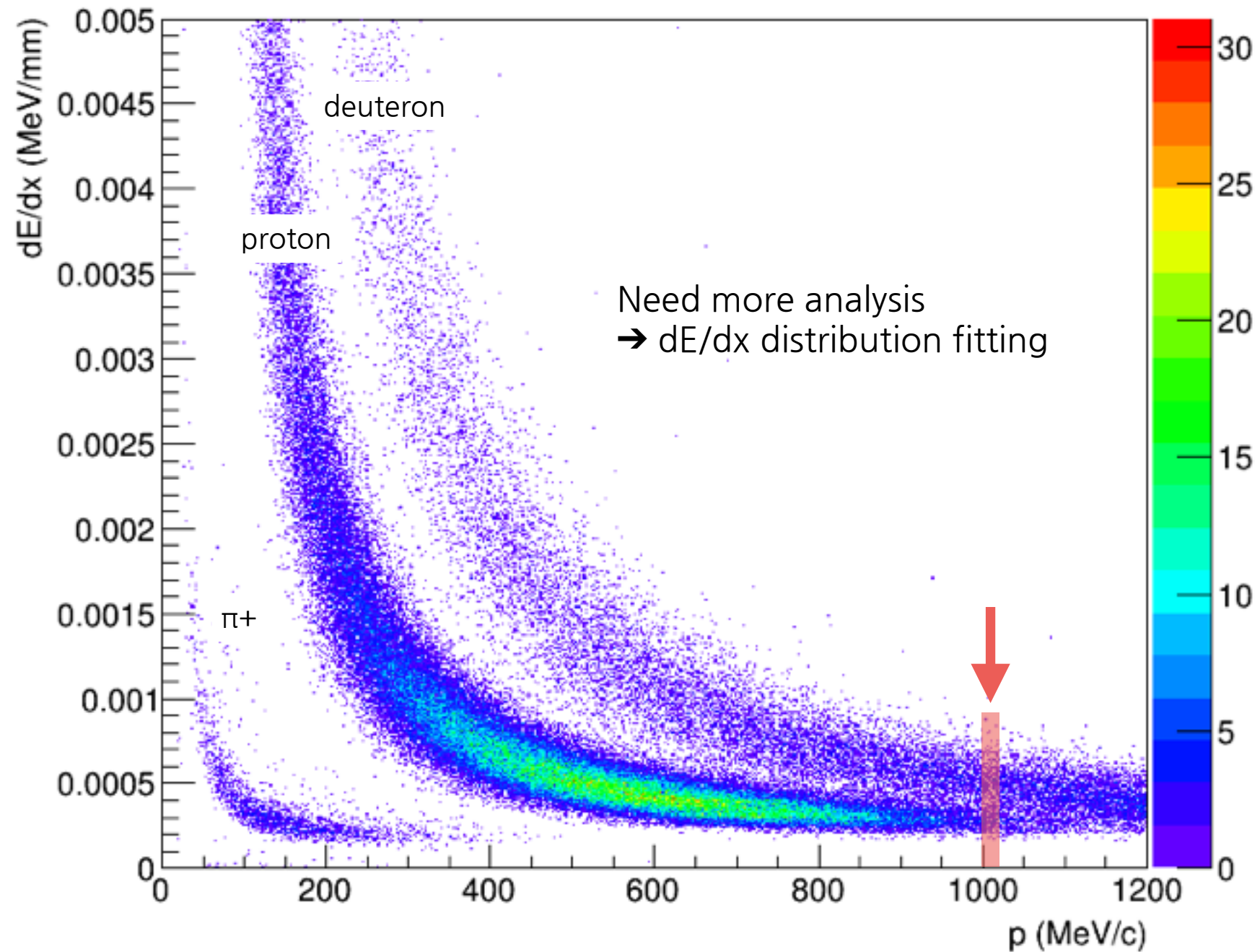
dE/dx Plot

Energy Resolution : 10%
Momentum Resolution : 5 %



dE/dx Plot

Energy Resolution : 10%
Momentum Resolution : 10 %

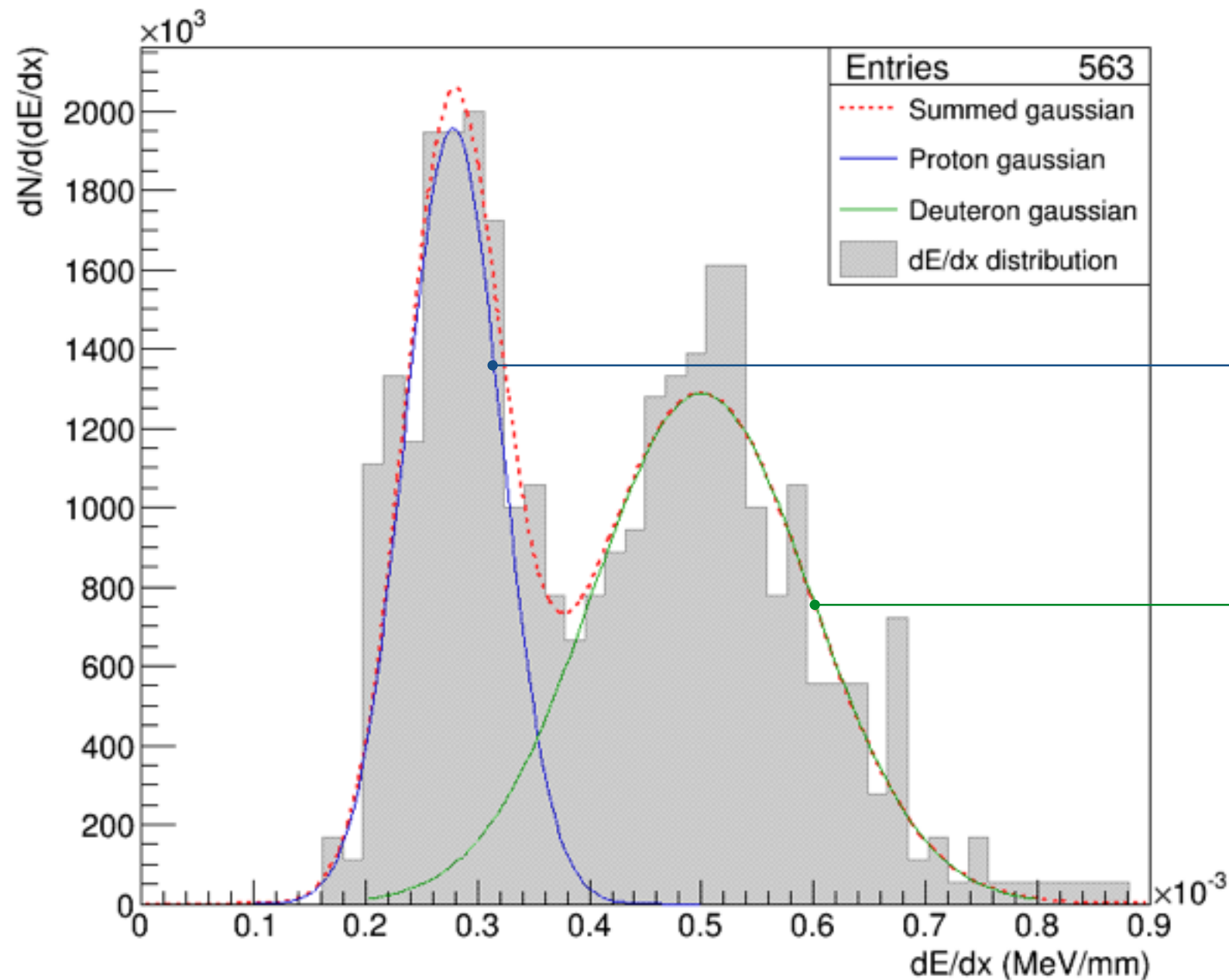


dE/dx Projection

Energy Resolution : 10%

Momentum Resolution : 10 %

Momentum Range (MeV) : $1000 < p < 1020$



Proton

Mean : 0.278×10^{-3}
Sigma : 0.043×10^{-3}
Resolution : 15.5 %

Deuteron

Mean : 0.500×10^{-3}
Sigma : 0.098×10^{-3}
Resolution : 19.6 %

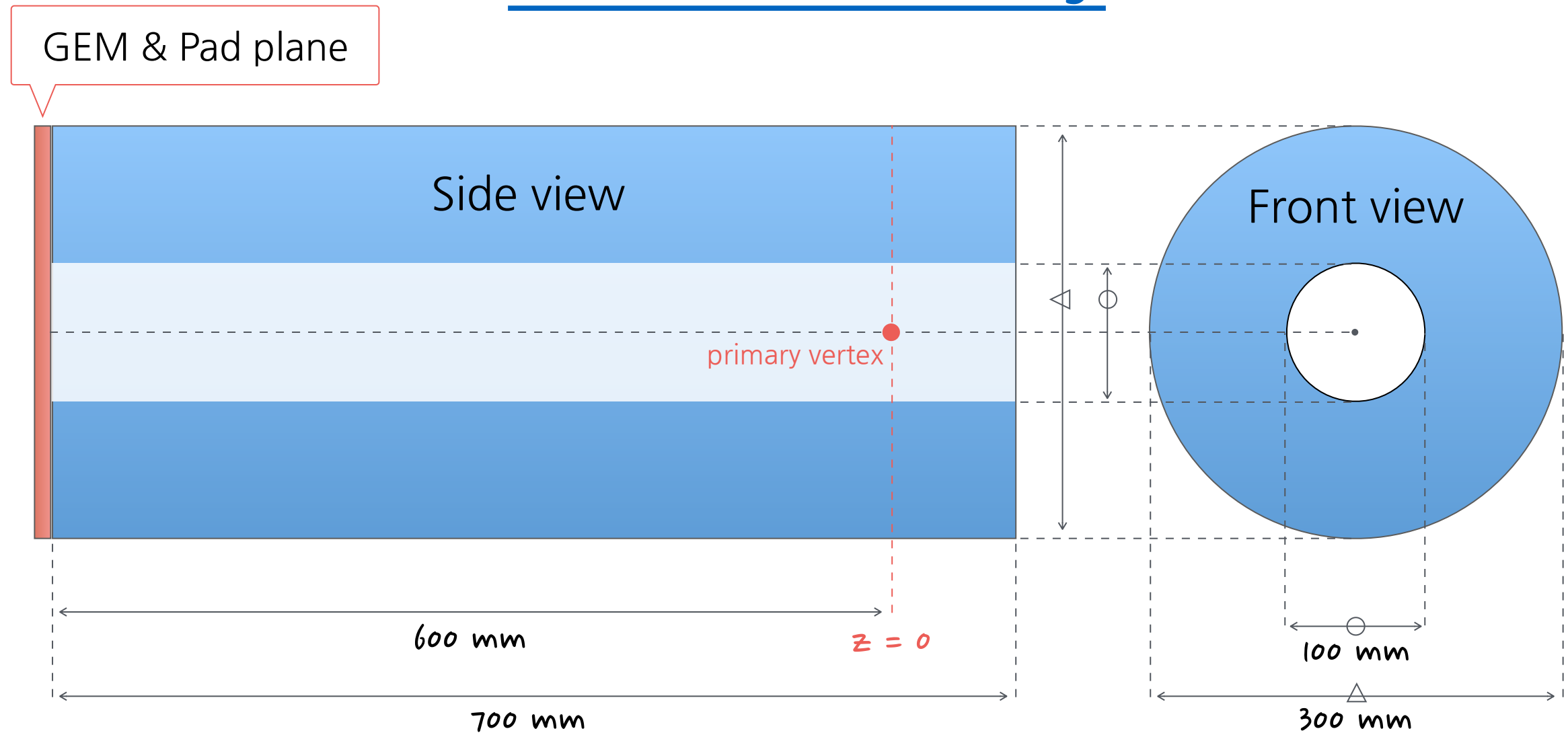
Summary

1. Bethe-Bloch Formula
2. Momentum resolution is dependent on value of momentum.

FOPIROOT

prototype

TPC Geometry



FOPIROOT

DIGI Macro

FOPI macro	Modified
extracted $z < 0$ data	included $z < 0$ data
drift length = z	drift length = $z - z_{\text{Gem}}$

Event Information

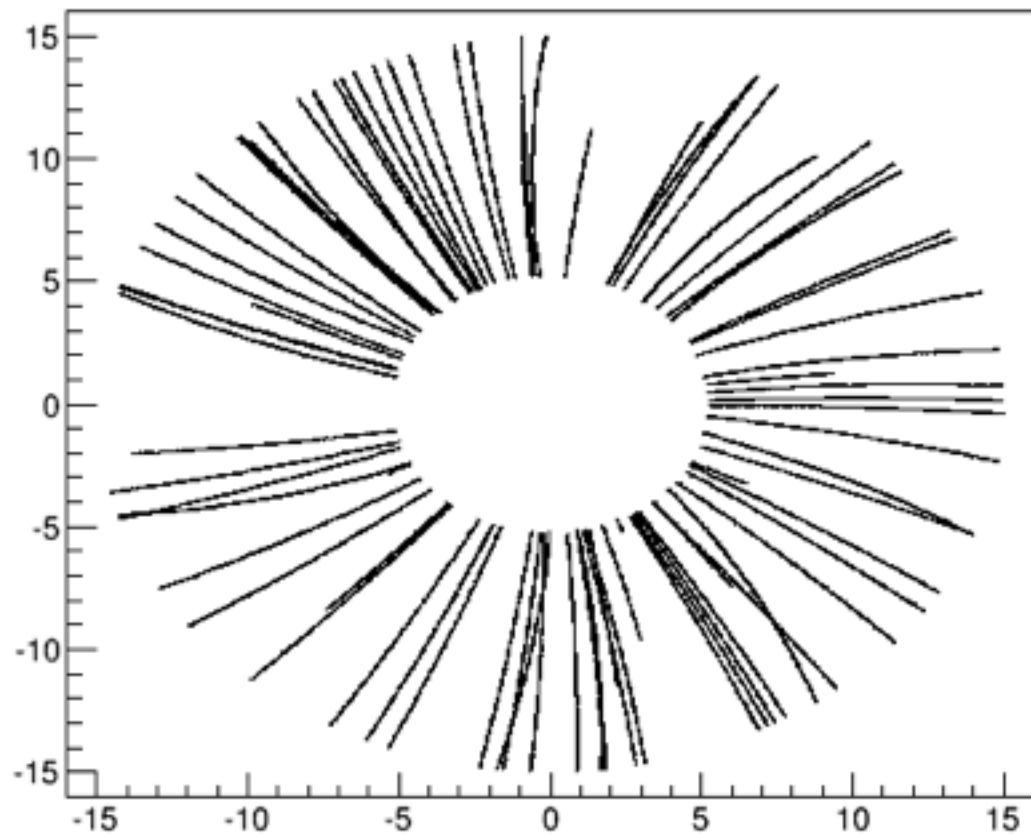
Proton(#100), 200 MeV, Random angle, 0.5 T(z)

FOPIROOT

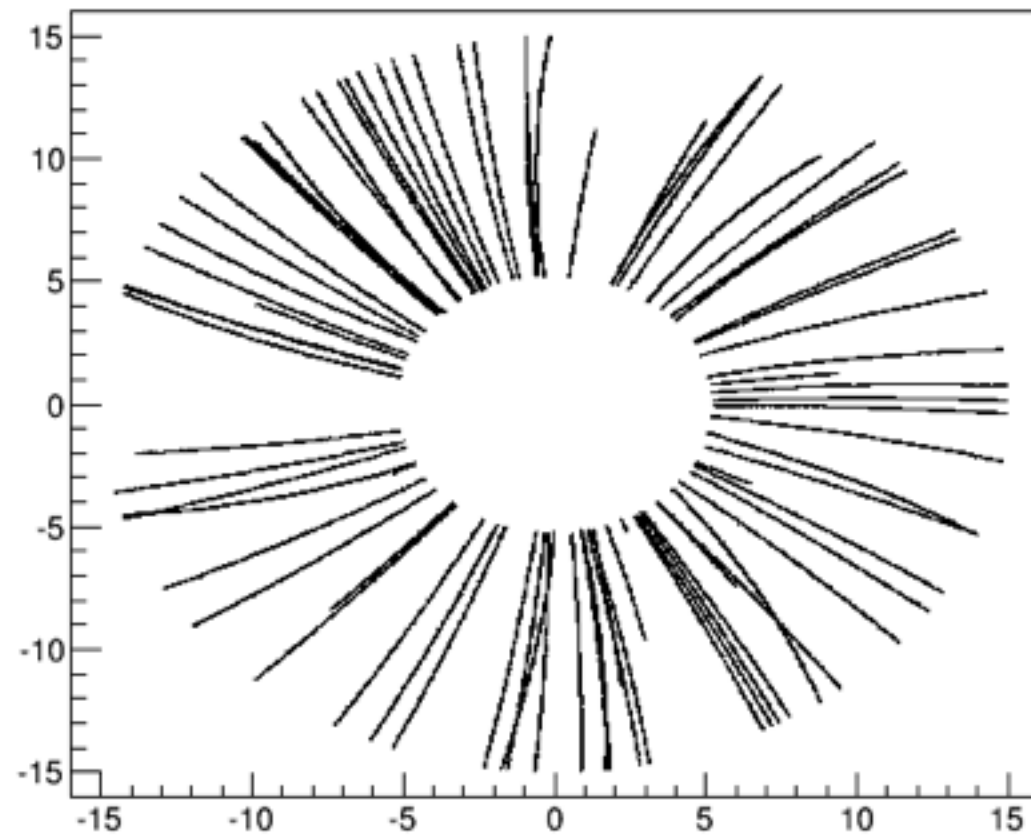
DIGI Tasks

Task	Data Set
MC	TpcPoint
TpcClusterizerTask	TPcPrimaryCluster
TpcDriftTask	TpcDrifedElectron
TpcGemTask	TpcAvalanche
TpcPadResponseTask	TpcSignal
TpcElectronicsTask	TpcDigi

TpcPoint x vs y (MC)

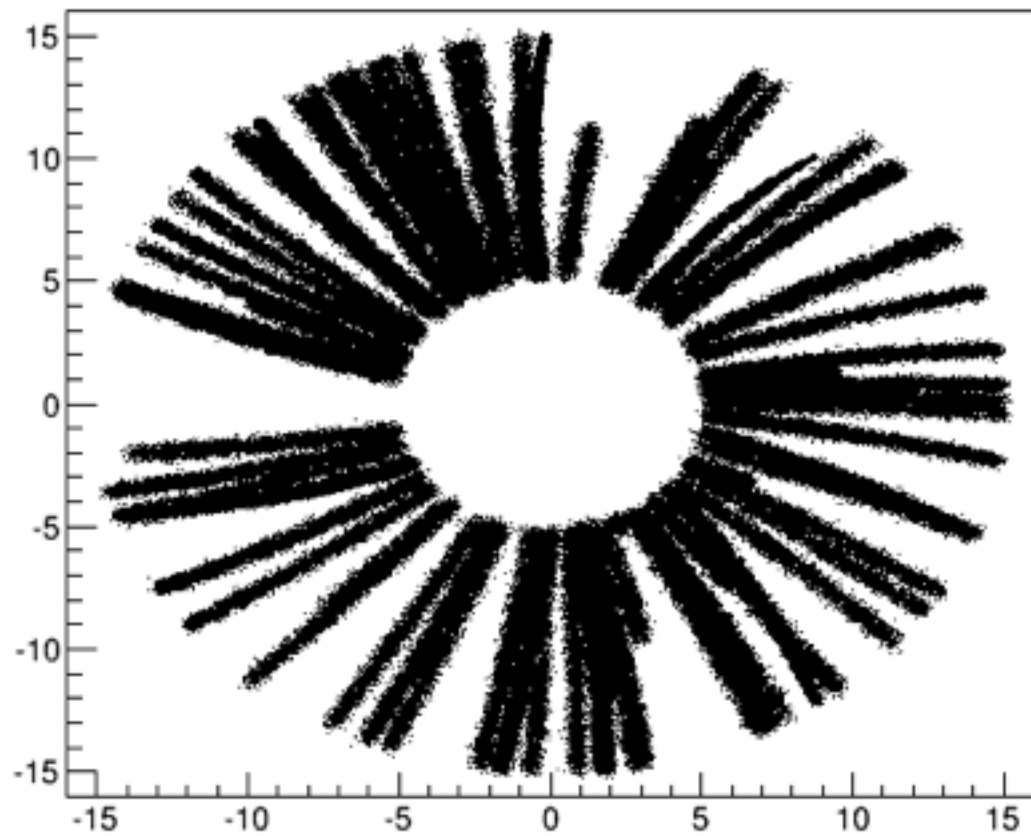


TpcPrimaryCluster.pos x vs y

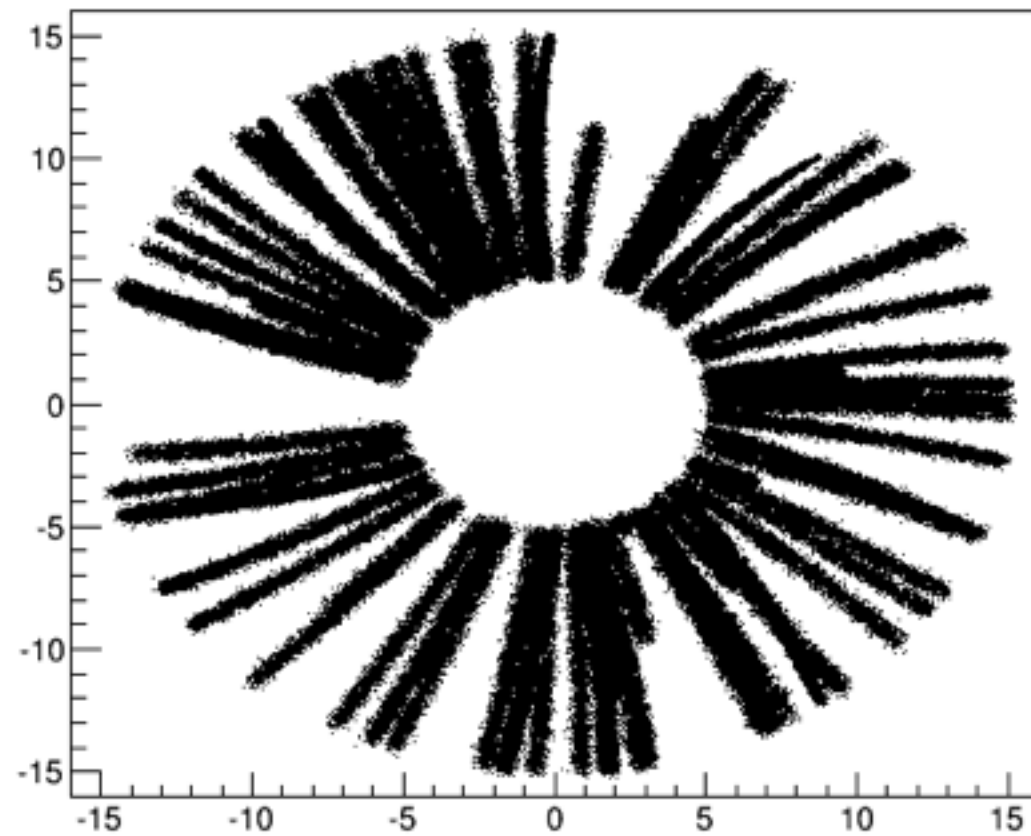


ROOT Geo.

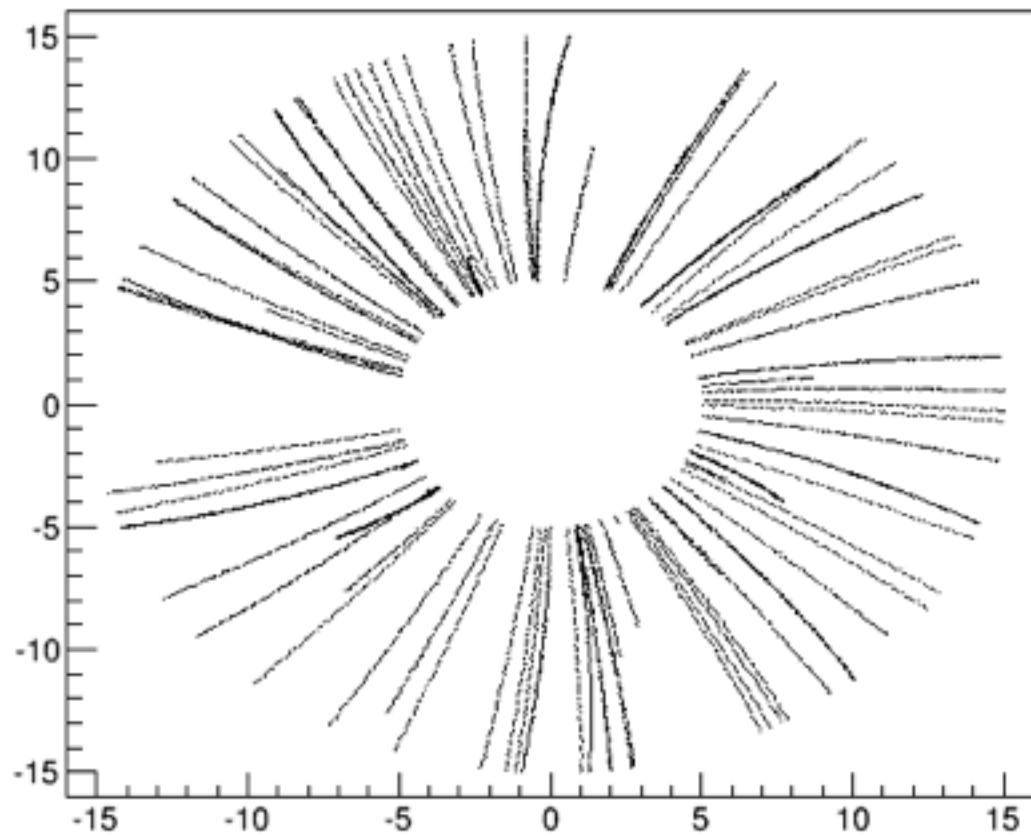
TpcDriftedElectron x vs y



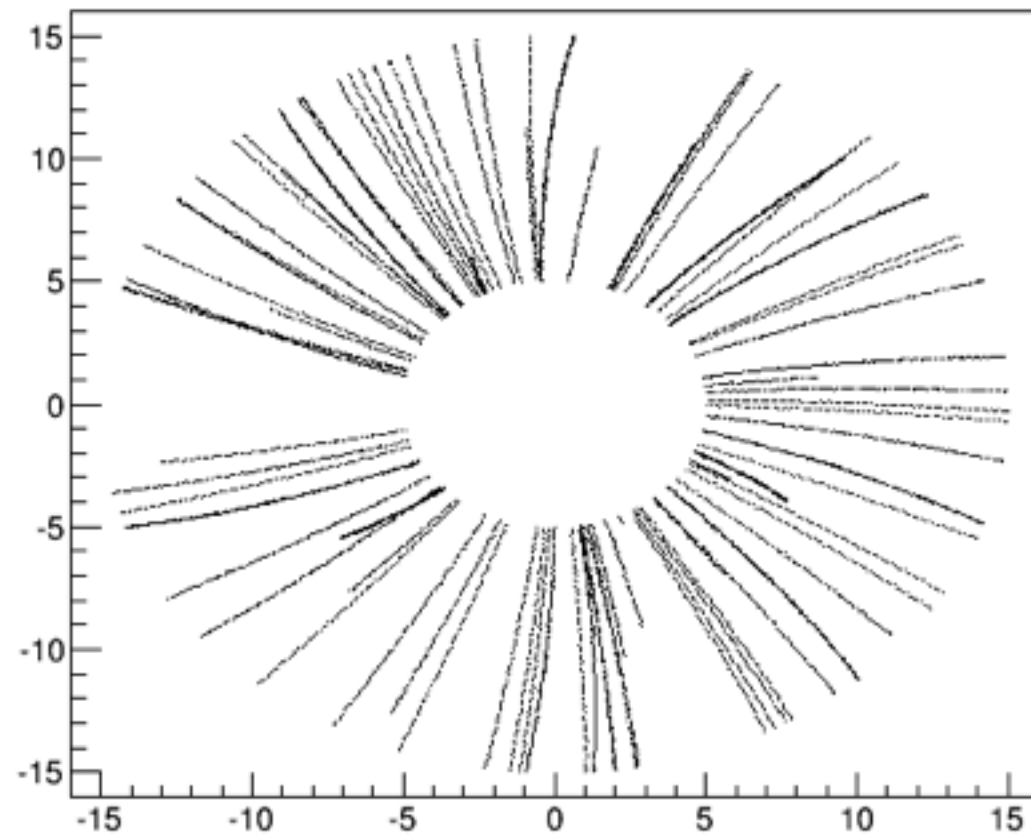
TpcAvalanche x vs y



TpcPoint x vs y (MC)

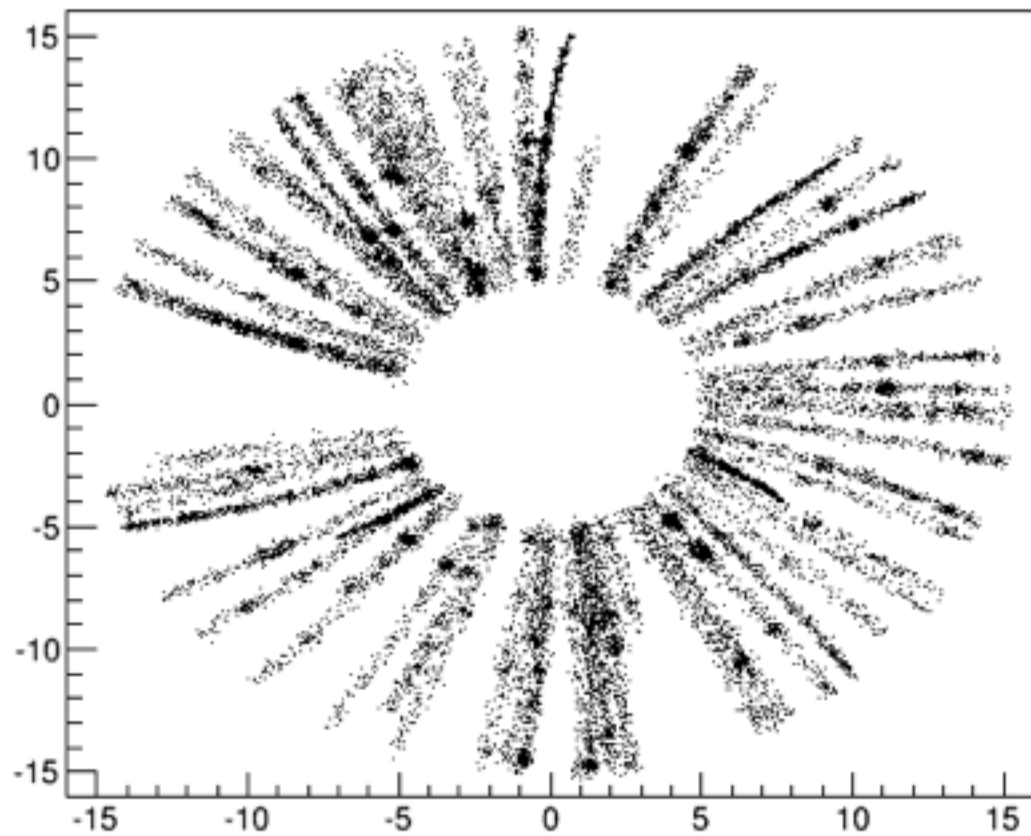


TpcPrimaryCluster.pos x vs y

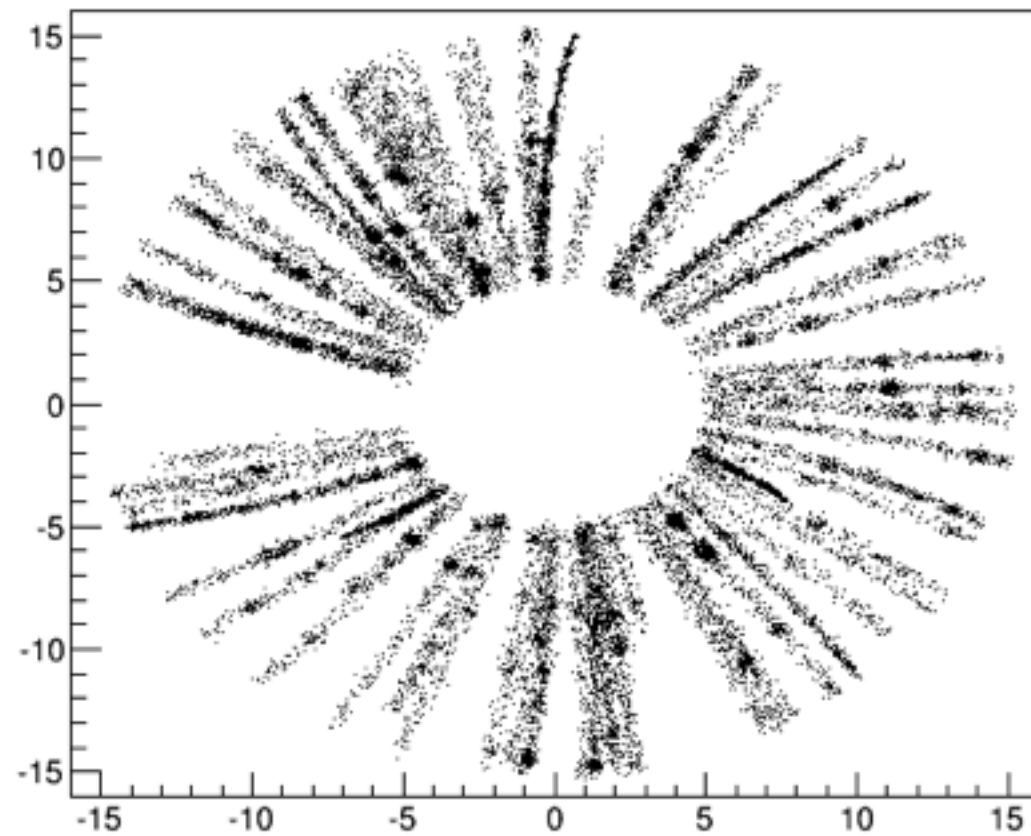


Ascii Geo.

TpcDriftedElectron x vs y

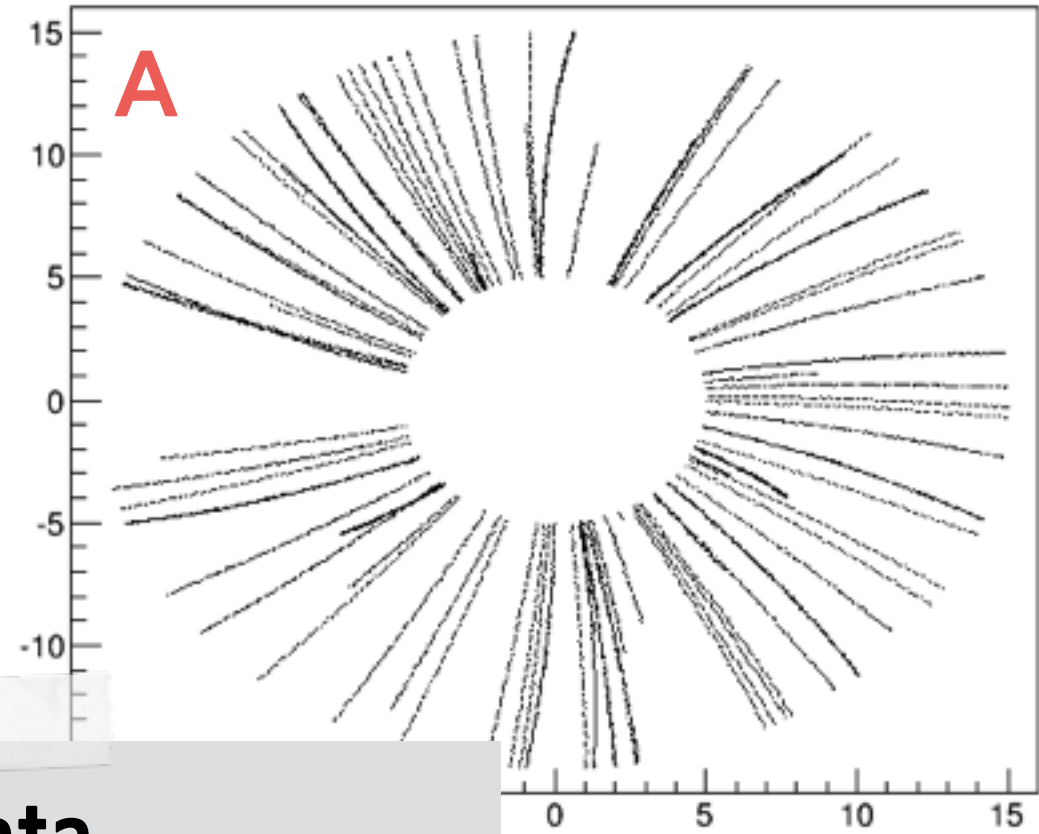
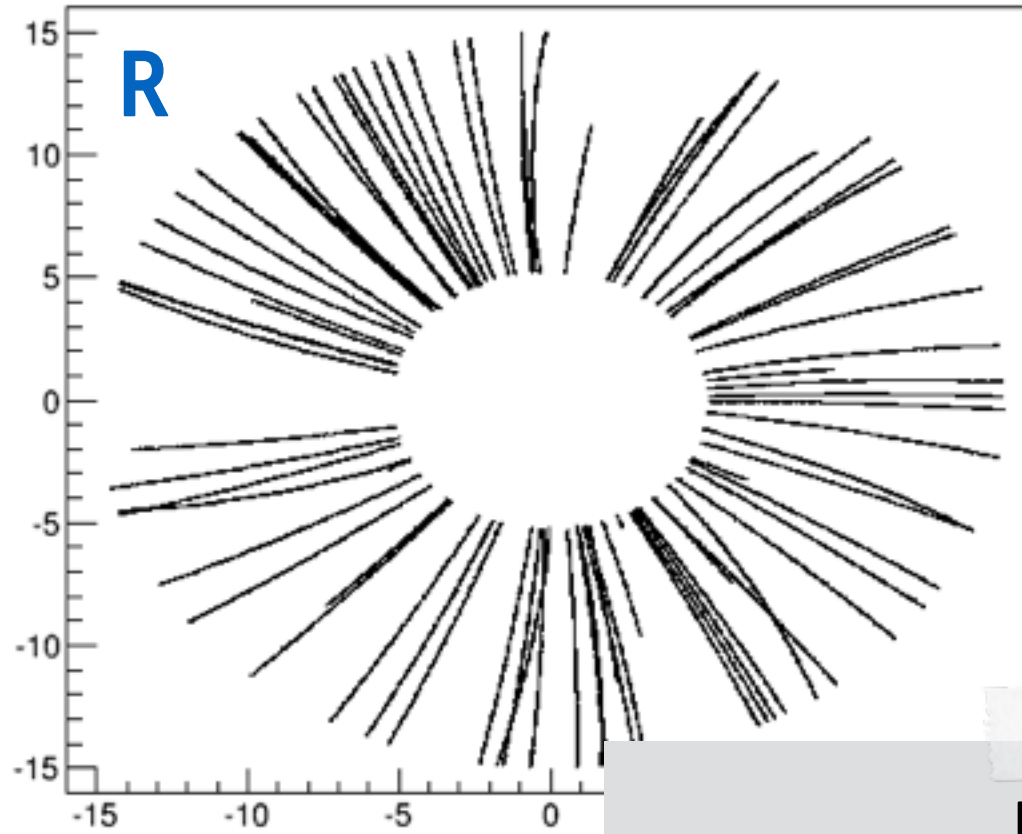


TpcAvalanche x vs y



TpcPoint x vs y (MC)

TpcPrimaryCluster.pos x vs y

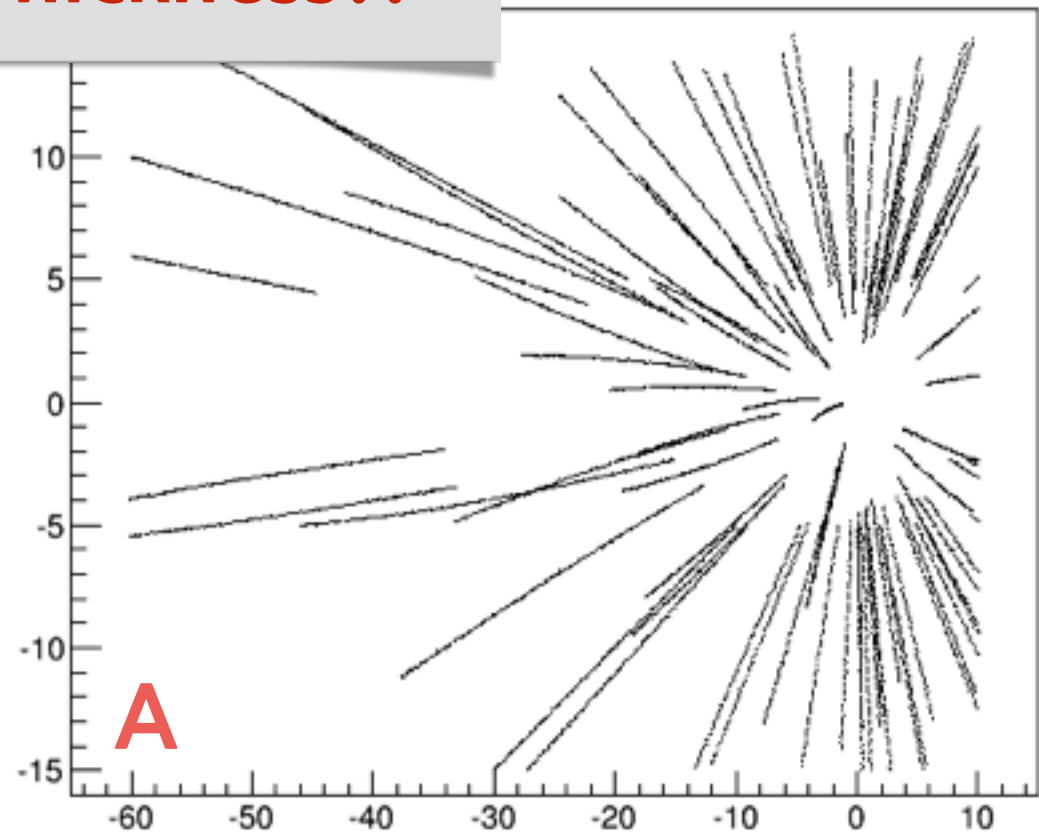
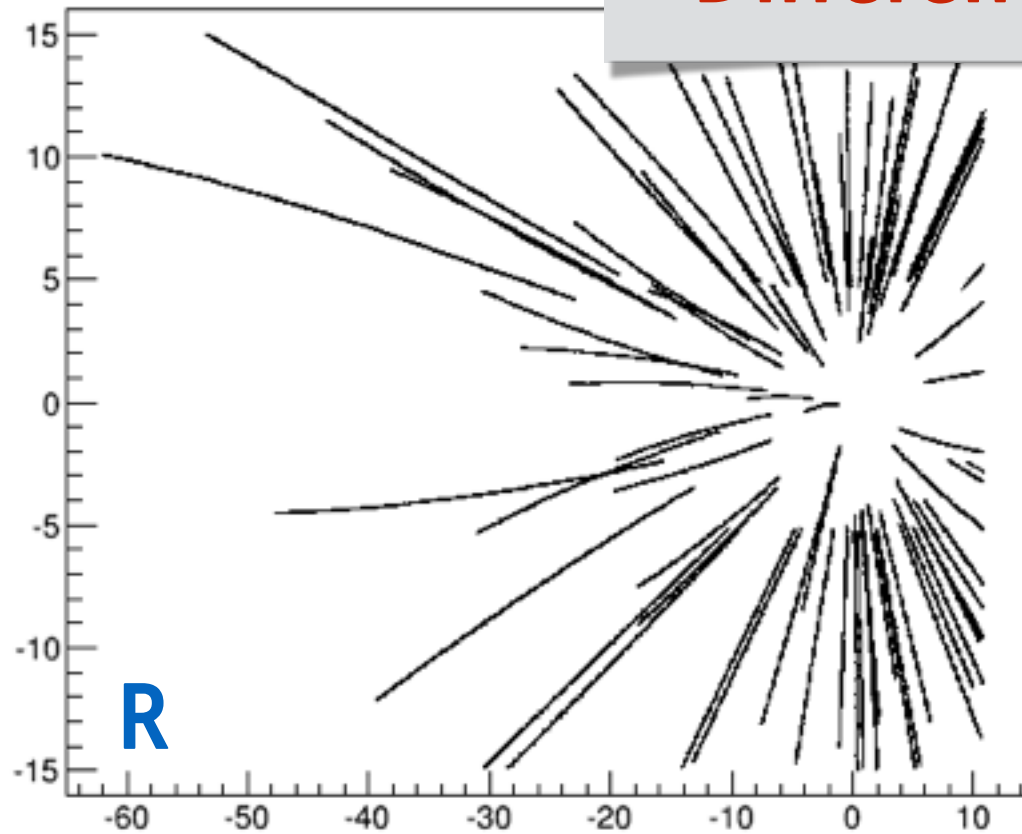


MC data

Difference in Thickness!!

TpcPoint z vs y

Cluster.pos z vs y



Summary

1. DIGI data still shows different output from two cases. (Gas problem?)
2. Try to get position of each pad (to read **TpcDigi**).
3. Reconstruction.